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VOL. LVI

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No. 2

**HYDROPS OF LABYRINTH (MENIERE'S DISEASE)
DIAGNOSIS — RESULTS OF LABYRINTH SURGERY.***

KENNETH M. DAY, M.D.,
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There has been so much confusion and disagreement as to the meaning of the term "Ménière's disease" that it would be well if the term were dropped from medical nomenclature and Ménière's name retained to apply only to the symptom complex or syndrome which is already universally accepted. This syndrome consists of the triad of dizziness, deafness and tinnitus. Since we now know that the pathologic process in the large group of idiopathic cases with Ménière's syndrome is a hydrops of the labyrinth, it would be far better to use this term in reporting these cases, as it is an accurate description of the condition which causes the labyrinthine disturbances. It is possible to diagnose accurately hydrops of the labyrinth and differentiate it from all other conditions which exhibit "Ménière's syndrome."

The interpretation of the term "vertigo" varies considerably. Vertigo is a subjective symptom, and we must rely on the patient's ability to describe his feelings. What the patient may call vertigo or dizziness may prove to be a faintness, giddiness, lightheadedness, blurring of vision or strange feeling in the head. It must be realized that true aural vertigo is always characterized by a sense of motion and a disorientation in space. The symptom may be mild and cause unsteadiness or staggering, or it may be more severe and the indi-

*Read at the meeting of the Middle Section of the American Laryngological, Rhinological and Otological Society, Inc., Minneapolis, Minn., Jan. 16, 1946.

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vidual will actually fall. The secondary symptoms of nausea and vomiting are indicative of the acuity or severity of the vertigo.

In the early stages of hydrops of the labyrinth, either the cochlea or the vestibular labyrinth may be involved separately, so that an accurate diagnosis is difficult to make. In succeeding attacks, with involvement of both parts of the labyrinth, the diagnosis can be readily reached. The cardinal symptoms of hydrops of the labyrinth are sudden, paroxysmal attacks of vertigo associated with deafness and tinnitus, frequently accompanied by nausea and vomiting, and recurring at varying intervals. The fact that the pathologic change is a fluid distention of the organs of hearing and balance would lead us to expect a distortion and diminution of the sensory responses of these organs. This is exactly what occurs.

1. *Deafness*: The deafness varies from time to time and involves the entire scale with decreased bone conduction, diplacusis and distortion of sound. Repeated audiograms often show a wide variation in the extent of the hearing loss. The patient hears tones at different pitches in the two ears, and usually will state that sounds seem blurred or fuzzy in the affected ear. In spite of the deafness, the affected ear is frequently hypersensitive to very loud sounds. Hearing tests show a perceptive deafness with uniform loss of hearing throughout the scale in the affected ear.

2. *Tinnitus*: Tinnitus nearly always accompanies the deafness. There is frequently a high pitched ringing or hissing of which the patients do not complain, but they complain bitterly of a low pitched pounding or roaring which is usually continuous even in the quiescent periods between active attacks. This tinnitus is usually pitched at a level between 100 and 300 d.v. The most frequent description of it is that it sounds like "surf pounding on the seashore" or like the sound of a seashell held to the ear, but magnified many times. This particular type of tinnitus is rarely present in any other condition, although there are many conditions in which there is a vascular intermittent throbbing tinnitus of a low pitch.

3. Labyrinthine Activity: Caloric tests shows either a non-functioning or hypoactive labyrinth on the affected side, and the amount of response to caloric tests varies at different times. As a general rule, the more severe the deafness the less the response of the labyrinth to caloric stimulation. The unaffected labyrinth also shows a diminished response. This is especially true of the vertical canals. The diminished response from the unaffected labyrinth apparently is due to a physiologic attempt on the part of nature to equalize the activity of the opposing labyrinths.

The above signs and symptoms are all suggestive of a varying endolymphatic distention with accompanying variation in the sensitivity of the end-organs involved. Thus there is found diplacusis, distortion of hearing, varying degree of deafness and low pitched tinnitus, and diminished and varying responses to stimulation of the labyrinth.

Hydrops of the labyrinth is a disease usually occurring in middle and later life. In my experience it is equally common in males and females. There are frequent spontaneous remissions during which the individual may be free of attacks for months or even years, only to have them recur with increased severity. During the remissions, however, the distention of the labyrinth continues though it is probably stationary and does not vary, since these patients usually continue to have deafness and low pitched tinnitus. The condition is usually unilateral but, in from 5 to 10 per cent of the cases, the second labyrinth may become involved. The acute attacks are probably precipitated by a sudden change in the amount of distention or pressure in one labyrinth which upsets the balance between the two opposing labyrinths; thus either an increase or decrease in the distention of the affected labyrinth may precipitate an attack. These patients frequently complain of imbalance or unsteadiness between the active attacks and of a feeling of pressure or fulness in the head. The attacks usually occur without warning, though some patients say they know an attack is coming on because the roaring tinnitus becomes suddenly louder. The fear of attacks is often intense, and many of these patients are afraid to ven-

ture outside of their homes. The etiology of hydrops of the labyrinth is still unknown. A definite allergic basis can be determined in some cases; I have seen a few individuals who have been completely relieved from the attacks with diminution of tinnitus and marked improvement in hearing following elimination of offending allergens.

Conservative treatment for hydrops of the labyrinth is often effective as a palliative procedure, but rarely is a cure for the condition. If the hearing in the affected ear improves and the tinnitus decreases with conservative treatment, these patients can be given a fairly favorable prognosis. In the majority of cases, conservative treatment may be successful in eliminating the acute attacks of vertigo. The most effective treatment in my experience has been the use of small subcutaneous injections of histamine plus elimination of any offending allergens. Injection of 0.1 cc. of a 1-100,000 solution of histamine base once or twice a week with gradually increasing doses seems to be the most effective. Most individuals will not tolerate more than 0.1 to 0.2 cc. of a 1-10,000 solution, although rarely there are patients who can take 0.5 cc. of a 1-10,000 solution. Not infrequently, an increase in the amount of histamine may precipitate an acute attack. I have seen only a few individuals who have responded to the administration of nicotinic acid, and I have had some success with histamine treatment even in cases who gave a negative skin test to histamine. The Furstenberg treatment has been of little value in my hands. Unless the patient is hospitalized, it is extremely difficult to control the sodium intake. Many patients refuse to take large doses of ammonium chloride and complain bitterly because of the complete lack of desire for any food while under treatment. Approximately 25 per cent of cases of hydrops of the labyrinth fail to respond satisfactorily to any form of conservative medical therapy. Moreover, the economic factor must not be lost sight of as many of these people are partially or totally incapacitated and unable to earn a livelihood. Surgical intervention must be considered in these cases.

The generally accepted surgical procedure has been total

or subtotal section of the VIIIth cranial nerve. This procedure has been effective in terminating the acute vertiginous attacks. It is, however, an extremely difficult intracranial procedure, is not devoid of danger, and the results in many cases have been very disappointing. With subtotal section of the VIIIth nerve, roaring tinnitus continues to be a very disturbing symptom, and the hearing which is preserved is of little value since it is distorted. Now that we know the condition in the labyrinth which is responsible for the symptoms in these cases, it seems entirely illogical to try to effect a cure of the disturbance by cutting off the end-organ from its connection with the brain. The logical point of attack is the labyrinth itself, and I am now completely convinced that operation upon the labyrinth is the surgery of choice for this condition; it is safe, simple and effective. The ideal surgical procedure should be effective in terminating the vertiginous attacks and tinnitus without destroying hearing; it should offer the least possible danger to the life of the patient. The best means of accomplishing this is by labyrinth surgery. I have been consistently successful in terminating the attacks of vertigo and in eliminating the low pitched roaring tinnitus in 19 consecutive cases of unilateral involvement but have had very poor success in preserving hearing. Two years ago I gave a preliminary report of labyrinth surgery on eight cases of "Hydrops of the Labyrinth."¹ At about the same time, Cawthorne² (in England) reported 52 cases with very encouraging results. This report concerns the results of operation in 21 cases in the past five years.

My operative procedure is as follows: A partial simple mastoidectomy is performed using the postauricular approach. The mastoid cells are exenterated only sufficiently to obtain adequate working space. The mastoid antrum is opened widely. The outer wall of the aditus is removed sufficiently to expose the incus. With a small motor-driven burr, a trephine opening is made in the horizontal semicircular canal just above and medial to the short process of the incus. Through an opening at this point a fine needle can be passed through the canal into the vestibule. With the point of the

(Continued)

DAY: HYDROPS OF LABYRINTH.

needle in the vestibule, a light coagulating current is applied two or three times. I have used the Davis-Bovie electrosurgical unit with the dial set between 18 and 25. Frequently a strong facial spasm occurs when the current is applied. In no case, however, has there been any resulting facial palsy. The needle is withdrawn; the mastoid cavity is allowed to fill with blood and the incision is closed with clips or sutures. The wound is usually healed and the dressing discarded by the fifth day. There have been no postoperative complications or temperature elevations in this series except for the formation of a hematoma which required partial evacuation in one case. Postoperatively, these patients have surprisingly little labyrinthine disturbance. Many of them are able to sit up and enjoy a full diet within 24 to 48 hours after operation. A few patients had rather severe postoperative labyrinthine reactions, but in no instance were they as severe as one would expect with the sudden destruction of one labyrinth. The degree of postoperative labyrinthine reaction can be estimated on the basis of the response to stimulation of the labyrinth preoperatively. The patients with severe deafness and very slight or no response to caloric stimulation before operation are those who have the least postoperative reaction. These patients are usually able to leave the hospital within a week or 10 days, and many of them are back at work and rehabilitated within three to four weeks. The low pitched roaring tinnitus usually disappears immediately following the operation, but the high pitched tinnitus continues and may be more pronounced. Postoperatively, these patients have some unsteadiness and imbalance, especially noticeable in the dark, for a few weeks, and rarely for a few months after operation. Two of the 21 patients upon whom I operated had bilateral involvement and continued to have some symptoms, mostly referable to the unoperated ear. One of these two patients is constantly giddy and unsteady but has had no acute attack of vertigo since operation two and one-half years ago. The other began having acute attacks from the unoperated ear four months after operation. Nineteen patients with unilateral involvement have all been rehabilitated and are completely free of vertigo and of low pitched roaring tinnitus. Many of

these were incapacitated and worked less than half-time for a period of years before operation. None of them has lost time because of vertigo attacks since operation.

I cannot report good results in the preservation of hearing. In some of the cases which I previously reported as having usable hearing in the operated ear, the hearing gradually diminished until there is complete loss, and this experience has been repeated in later cases. It is very difficult to estimate residual hearing in one ear when there is normal hearing in the opposite ear because, in unilateral deafness, amplified sound can be transmitted to the normal ear in spite of presumably adequate masking. This is equally true of audiograms made before and after operation. I have, therefore, discounted cases whose hearing loss in the affected ear post-operatively averaged more than 60 db.

In spite of the fact that there is complete deafness in the affected ear postoperatively in most of the cases, many of the patients insist they hear better than before operation because of the elimination of the roaring tinnitus which was previously present.

Thus it is seen that out of 21 cases, there are only three in which there is definite usable hearing in the affected ear following operation. This, however, would seem to be of minor importance if we recall that the hearing present in the affected ear before operation was distorted and was a detriment rather than an asset.

The fact that in one case in this series the hearing, which showed an average loss of 70 db. before operation, improved to within normal limits postoperatively and has remained so for four years, convinces me that eventually this operation can be so modified as to give a better prognosis for the maintenance and improvement of hearing.

I have been making variations in administering the coagulating current in the vestibule in this series in an attempt to find a method which will result in preservation of practical hearing. I have varied the dial setting between 18 and 25 and believe the stronger current is preferable, as the one case

in which the dial was set at 18 was Case 13 and, apparently, there was incomplete destruction of the vestibule in this case. For three to four weeks following operation, loud noises would cause the patient's head to jerk involuntarily. The fact that a few of these patients had good hearing immediately postoperatively, which later declined, makes me believe that an open perforation must have existed in the membranous labyrinth which resulted in a gradual loss of endolymph and a consequent loss of hearing. If the coagulating current could be so controlled as to seal off the perforation of the membranous organ made by the needle, the chance of preserving hearing should be improved. A slight withdrawal of the needle after the first application of current, followed by a second or third application with the needle thus withdrawn, would seem to offer a better chance of sealing off the perforation of the membranous organ.

CONCLUSIONS.

Successful results from labyrinth surgery in 19 consecutive cases of unilateral hydrops of the labyrinth have convinced me that this procedure is no longer experimental but is the operation of choice for this condition. Moreover, I believe this or some similar procedure should replace the intracranial procedure of VIIIth nerve section. I now feel fully justified in advising operative interference for those cases of hydrops of the labyrinth that do not respond to conservative therapy or that are losing enough time from their occupation to cause an economic handicap.

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121 University Place.

HABITUATION TO CALORIC VESTIBULAR STIMULATION.*

WALTER E. LOCH, M.D., and HENRY L. HAINES, M.D.,
Baltimore, Md.

Habituation is well known to result from repetition of physiologic types of vestibular stimulation, such as rotation in clinical tests or in dancing, the motion of a ship or of a swing. Extensive studies have been made, both with human and with animal subjects, of the habituation induced under such conditions. Habituation to caloric stimulation, despite the fact it is the stimulus most commonly used in clinical tests of vestibular function, has not received attention. The results of the studies with rotation tests do not form a sufficient basis for predicting to what degree habituation occurs to repeated caloric stimulation, because the caloric stimulus is nonphysiologic and, therefore, not ordinarily encountered in daily life, and because only one of a paired organ is stimulated. The present study shows that changes do occur in the reactions to caloric stimulation repeated at daily intervals. The observed changes are believed to be due to habituation and to be of clinical interest.

All tests have been made on human subjects, with a minimal caloric stimulation technique. Two methods were used: 1. with the head inclined backwards 60° the external canal was irrigated with 3 cc. of ice water; 2. with the head bent sideways to the horizontal and the chin rotated upwards 45° from this position as described by Atkinson,¹ 1 cc. of ice water was instilled into the external canal in such a manner that air was not trapped in the canal. After 10 seconds the head was brought back to midline and inclined backwards 60°. Special care was taken to avoid fixation of the eyes. The room was fairly dark. The patient was seated with the back toward the window and about six feet from it. The eyes

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were observed with Frenzel glasses (lenses of 20 diopters and lateral illumination); this procedure eliminates fixation and makes observation of the details of the eye movements easier. The observer stood in front of the patient, carefully avoiding movements. The duration of the nystagmus differed somewhat in the five subjects but the observed phenomena were similar. During the first test a slight vasomotor reaction was noticed: the face was slightly flushed and slight perspiration of the forehead and hands was noticed. This was followed after a short time by pallor of the face. The nystagmus showed the typical course. After the latent period, the nystagmus reached a certain strength which it maintained during a period of time, declined slowly and terminated in series of nystagmus beats of short duration, inter-

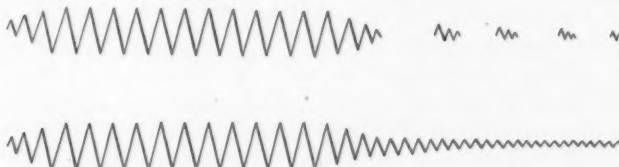


Fig. 1. The upper line is a diagrammatic representation of the nystagmus induced by the first caloric test of a man not accustomed to this type of vestibular stimulation; the lower line shows the pattern of the nystagmus induced in the same man by a similar caloric stimulus four days later, after one test had been made each day. The total duration of nystagmus was the same on both occasions.

rupted by free intervals (see Fig. 1). (This course of nystagmus is known and referred to as "main and after beats" by E. Hopmann.² Frenzel³ speaks of "fine, single beats.") The caloric tests done on each subject the next day showed a definite diminution of the vasomotor reaction. The terminal nystagmus with the free intervals was still noticeable. On the third day the vasomotor reaction was missing, and the free intervals of the terminal nystagmus were not clearly seen. By the fourth or fifth day the free intervals were missing. Instead, a regular decline of the nystagmus beats was observed after the nystagmus had reached its maximal point. The total duration of the nystagmus for each subject was about the same as it was in the first test. The pattern of the

nystagmus is shown in the lower line of Fig. 1. After a period of five to eight days without vestibular stimulation (shorter periods were not employed), the free intervals of the terminal nystagmus were again present but not as marked as in the first test, and they disappeared again after caloric tests were performed for two or three successive days.

The observed changes in reactions can best be explained as the result of habituation to the stimulus used. Since the duration of the nystagmus remained practically the same, and since the changes observed in these experiments affected only the terminal nystagmus, it is probable that they were caused by partial elimination of the inhibitory action of the central nervous system to vestibular impulses.

CONCLUSIONS.

1. Habituation to vestibular stimulation is not limited to the physiologic form of stimulus, rotation, but results also from the nonphysiologic caloric stimulus.
2. If the course of the terminal nystagmus in clinical tests shows deviations from the usual pattern, central rather than peripheral changes should be considered.
3. Some differences in timing the total duration of nystagmus might be accounted for if a free interval of the terminal nystagmus is taken as the actual end of the nystagmus.

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AMERICAN BOARD OF OTOLARYNGOLOGY.

The next examination of the American Board of Otolaryngology will be held in Chicago at the Palmer House from May 22 to 25.

THE CLOSURE OF OROMAXILLARY FISTULAE— A PRELIMINARY REPORT.

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Detroit, Mich.

Various techniques have been reported in the past for the surgical correction of oromaxillary fistulae complicating dental extraction. In the author's experience these techniques, either the mucous membrane flaps or the osteoplastic flaps, have been difficult to perform and occasionally gave unsatisfactory results.

A new and simple method for the surgical correction of oromaxillary fistulae has been tried with success and has prompted this preliminary report. A more complete description of the operative technique and analysis of case reports will follow in a subsequent paper.

Oromaxillary fistulae can be adequately and permanently corrected by simply inserting into the fistula a plug made from preserved cartilage. The fistulous tract is first thoroughly curetted to remove all granulations. A suitable piece of preserved rib cartilage is shaped into a cone with a sharp knife. An ordinary inexpensive pencil sharpener can be used to make a smooth cone. The point of the cone is inserted into the fistula until the cartilage graft is tightly wedged therein. That portion of the cartilage cone external to the bony opening of the fistula is then cut level to the surrounding bone. A mucous membrane flap to cover the exposed cartilage has not been found essential to complete healing of the fistula. The associated suppuration of the maxillary sinus is treated post-operatively by irrigations through the natural ostium at biweekly intervals. If suppuration in the involved maxillary sinus should persist, a Caldwell-Luc or intranasal antrostomy operation may be performed at a later date after the cartilage graft has healed in place.

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In long-standing oromaxillary fistulae with marked polyoid degeneration and hyperplasia of the antral mucosa, a Caldwell-Luc operation is performed at the same time that the cartilage plug is inserted into the fistula. After removing the entire diseased antral mucosa and establishing a clean window into the inferior meatus the antrum is filled with 5 gm. of sulfathiazole powder and the gingival incision closed without resorting to packing either in the antrum or the inferior meatus. If bleeding should occur postoperatively it is usually slight and can ordinarily be controlled by the intramuscular injection of pitressin in doses of 0.5 to 1 cc. at hourly intervals. Packing of the antrum and nose is purposely omitted since it promotes infection and delays healing.

1553 Woodward Avenue.

COURSE IN AUDIOMETRY AND FITTING OF HEARING AIDS.

The State University of Iowa will offer as a feature of its full program in speech pathology and hearing conservation, during the 1946 Summer Session, an intensive course in audiometry and the fitting of hearing aids. The course will run from June 17 to July 29 and is designed to train technicians as lay assistants to otologists; school nurses in public school hearing testing; executive secretaries in leagues for the hard of hearing; and others interested in hearing conservation. Any person who meets college entrance requirements is eligible. The first 24 students whose applications are received will be accepted for the course. Applications may be made to Prof. Wendell Johnson, Director of the Speech Clinic, University of Iowa, Iowa City, Iowa.

THE USE OF THROMBIN IN RHINOLOGIC SURGERY.
A PRELIMINARY REPORT.*†

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For many years attempts have been made to commercially produce thrombin as a hemostatic, but only in the past few years has this been achieved. Thromboplastic substances were formerly available, but their ability to produce hemostasis and clotting were dependent upon the presence in the tissues of platelets, prothrombin, calcium and perhaps other substances for the release of thrombin. Frequently these ideal conditions were not present, and the use of the thromboplastic product was of no value.

Thrombin requires no intermediate physiological agent for its action. It clots the fibrinogen of the blood directly, and is, therefore, even effective in hemophyliacs. Recently the topical use of thrombin has proven of great value in military surgery. It is not only an effective hemostatic in the control of capillary bleeding but also serves as an excellent tissue "glue" in promoting rapid adhesion of wound edges and for "suturing" the skin edges in surgical incisions. In these latter instances thrombin is employed in conjunction with plasma, and the released fibrin acts as the binding agent between the wound surfaces.

The author felt that complete and effective hemostasis in nasal surgery would lessen the reaction of the tissues, aid in the prevention of septal hematoma, reduce postoperative hemorrhage and effect a more rapid restoration to normal of the nasal tissues with re-establishment of the nasal airway and the ventilation of the paranasal sinuses. In rhinoplasty,

*"Thrombin, Topical" (bovine origin) was the product used in all cases in this investigation. The author wishes to acknowledge the kindness of Parke, Davis & Company for supplying the product.

†From the Department of Otolaryngology of the University of Maryland School of Medicine and the Otolaryngologic Service of the South Baltimore General Hospital.

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it was felt that the fibrin-fixation of the tissues ("glue" effect) would be of great value in preventing postoperative edema and tissue thickening with resultant thickening of the nose. With these thoughts in mind, the effects of the topical application of thrombin during surgery were studied in a series of rhinologic operations. At the time of writing, 34 rhinologic operations have been performed on 29 patients in which thrombin was employed. The results are reported here as a preliminary study. (Thrombin has also been used successfully on a small series of selected cases of tonsillectomy, post-tonsillectomy bleeding, etc., and these will be reported at a later time.)

TECHNIQUE.

After completion of the surgical procedures during submucous resection, and before insertion of the packing, thorough removal of all blood was accomplished by careful spot-suctioning in the nose and between the flaps. A solution containing 1,000 Iowa units of thrombin per cc. was mixed and, using a 5 cc. syringe and dull-pointed fistula needle, approximately 2,500 units of the thrombin solution were sprayed between the septal flaps. The flaps were then held in apposition for several minutes by inserting a long-bladed nasal speculum, following which they were found to be tightly adherent. The author has always routinely sutured all submucous incisions with two or three atraumatic No. 0000 black silk sutures, and this practice has been continued. (This procedure may soon be dispensed with, however, as the wound edges become tightly sealed on application of a drop of the thrombin solution.) If any turbinal surgery has been performed, the thrombin solution was also sprayed over the cut surfaces prior to insertion of nasal packing. The author routinely uses two three-quarter-inch cigarette drain packs on each side, supplemented by half-inch petrolatum gauze for the ethmoid and vestibule regions. This packing has been found to provide better splinting for the septum, and it is removed with less discomfort and considerably less bleeding than gauze alone.

In rhinoplasty, after completion of the operation, the same

Case	Operation	Postoperative Complications	Submucous Resections		Rhinoplasty		Postop. Edema	Postop. Ecchymosis	Remarks
			Septum Postop.	Airway Postop.	Splint Removal 6 days	Postop.			
1	Secondary rhinoplasty	None	—	—	—	—	None	None	Double osteotomy performed bilaterally
2	Submucous resection and rhinoplasty	None	Thin and tight	Good in 5 days	6 days	Very slight	None	—	
3	Submucous resection	None	Thin and tight	Good in 5 days	—	—	—	—	
4	Secondary rhinoplasty	None	Thin and tight	Good in 5 days	—	—	—	—	
5	Submucous resection	None	Thin and tight	Good in 5 days	6 days	Very slight	None	—	
6	Submucous resection and rhinoplasty	None	Thin and tight	Good in 5 days	—	—	—	—	
7	Submucous resection and rhinoplasty	None	Thin and tight	Good in 5 days	5 days	Very slight	Very slight	—	
8	Submucous resection	Ac. rhinosinusitis	Thin and tight	Good in 13 days	—	—	—	—	
9	Secondary submucous resection	Septal edema	Thin and tight	Good in 20 days	—	—	—	—	
10	Submucous resection and rhinoplasty	Septal perf., low	Thin and tight	Good in 7 days	6 days	Very slight	None	—	
11	Submucous resection	None	Thin and tight	Good in 7 days	—	—	—	—	
12	Secondary submucous and rhinoplasty	None	Thin and tight	Good in 5 days	—	—	—	—	
13	Submucous resection and bilat. antrostomy	None	Thin and tight	Good in 10 days	5 days	Moderate	None	—	
14	Submucous resection	Ac. rhinitis	Thin and tight	Good in 10 days	—	—	—	—	
15	Submucous resection	Septal hematoma	Thin and tight	Good in 24 days	—	—	—	—	
16	Rhinoplasty	None	—	Good in 30 days	3 days	Moderate	Slight	—	
17	Submucous resection and bilat. antrostomy	None	Thin and tight	Good in 6 days	—	—	—	—	
18	Submucous resection	None	Thin and tight	Good in 6 days	—	—	—	—	
19	Submucous resec. and left mid. turbinatectomy	None	Thin and tight	Good in 4 days	—	—	—	—	
20	Rhinoplasty	None	—	—	5 days	Slight	None	—	
21	Rhinoplasty	None	—	—	6 days	Moderate	Slight	—	
22	Submucous resection	None	Thin and tight	Good in 6 days	—	—	—	—	
23	Submucous resection	None	Thin and tight	Good in 4 days	—	—	—	—	
24	Submucous resection and rhinoplasty	None	Thin and tight	Good in 12 days	5 days	Slight	None	—	
25	Submucous resection	Adhesions	Thin and tight	Good in 20 days	—	—	—	—	
26	Submucous resection	None	Thin and tight	Good in 5 days	—	—	—	—	
27	Submucous resection	None	Thin and tight	Good in 7 days	—	—	—	—	
28	Rhinoplasty	None	—	—	6 days	Slight	None	—	
29	Submucous resection	None	Thin and tight	Good in 3 days	—	—	—	—	

Rhinitis persisted for 3 wks.
(See descriptive text)
Patient removed splint while
asleep during nightmare

Edema on dorsum persisted
for 3 weeks
(See descriptive text)

strength thrombin solution was sprayed beneath the skin of the dorsum and firm pressure was applied over the nose with gauze for several minutes. All bleeding was immediately controlled, and the skin quickly became adherent to the underlying bone and cartilage. It is important, therefore, that the skin be placed accurately and exactly where desired, as after a few minutes it can be removed only by the use of a knife or periosteal elevator to break up the fibrin adhesions.

SUMMARY OF CASES.

This series consists of 29 cases. In 18 cases, submucous resection was performed; six cases were of rhinoplasty alone, and in five cases combined submucous resection and rhinoplasty was done. In all, 34 rhinologic operations were performed. The essential data about each case is presented in the table.

COMMENTS ON CASES.

Case 8 developed an acute rhinosinusitis several days post-operatively and this necessitated daily office treatment. In spite of this, all tissue reaction had subsided by the thirteenth day and the septum appeared thin and tight.

Case 9 was a 40-year-old white woman who had had a submucous resection only six months previously by another surgeon without relief of symptoms. The septum was still markedly deflected to the left, thickened and in contact with a hypertrophied left middle turbinate. A secondary submucous resection was performed, almost entirely by sharp dissection through highly vascular scar, removing all deflected bone. Considerable bleeding was encountered, which was entirely controlled by the application of thrombin and insertion of nasal packing. Following removal of the packs in about 20 hours, the septum became thick and boggy, but aspiration failed to recover free blood and the incision was not reopened. After one month the septum became quite thin and straight, but there was a small string adhesion between the septum and the stump of the resected left middle turbinate. This adhesion was excised and prompt recovery followed.

Case 15 was a difficult submucous resection in which it was necessary to remove a portion of the anterior nasal spine in addition to the bony intermaxillary ridge. A gouge and mallet were employed for this purpose, and a relatively large bone artery was encountered. Bleeding was controlled by pressure before the application of the thrombin solution. Next day the packs were removed. Within several hours the patient developed a large septal hematoma. The incision was immediately reopened and a large quantity of fresh, uncoagulated blood was evacuated with suction. There was active arterial bleeding from the floor, so that tight intranasal gauze packing was reinserted on both sides in order to control the bleeding. No further bleeding occurred, but the septum remained thick for some days and several band adhesions resulted. Following excision of the adhesions, the septum became thin in one month.

Case 25 was a 54-year-old white woman who had just recovered from an acute coryza. She had a persistent positive serology in spite of much therapy, and there was moderate hypertension present (170/95). Considerable bleeding was encountered on the table (which was not controlled by adrenalin), a septal tear occurred during the dissection, and much bleeding occurred when the packing was removed the next day. Several adhesions resulted but these were excised and the end-result was good, though somewhat delayed.

OBSERVATIONS.

Following the use of thrombin topically in submucous resection, the following observations were made. There was a mild stinging sensation when the thrombin solution was applied, but no untoward reactions were observed in any case. Hemostasis of capillary bleeding was practically immediate, but in the case in which a bone artery had been severed, thrombin was ineffective in maintaining hemostasis. The septal flaps became tightly adherent within a few minutes and the incision became tightly sealed in every case.

The nurses reported that postoperative oozing through the

packing was practically *nil* in the cases in which thrombin had been applied. With the exception of Case 25, there was less bleeding than is usual when the packs were removed. There was considerably less postoperative reaction of the nasal tissues, the nasal airway was re-established in an average of eight days in this series, and the septum was thin and tight in practically every case.

Following rhinoplasty, the skin over the dorsum became tightly adherent within a matter of minutes. There was much less postoperative edema and almost no ecchymosis. In every case all edema had subsided and the nose was practically normal in appearance in about two weeks. It was possible to discard the nasal splint in five or six days, and probably even sooner, whereas previously the splint was kept on for 10 to 14 days. (The author contemplates removing the splint in 24 hours when thrombin is employed as described.)

With the exception of Case 15, in which a bone artery was severed during the operation, in no case in this series did postoperative hemorrhage occur.

CONCLUSIONS.

1. A series of 29 cases of rhinologic surgery in which thrombin was used topically is presented as a preliminary report. In 18 cases submucous resection was performed, six cases were of rhinoplasty alone, and in five cases combined submucous resection and rhinoplasty was performed.
2. The topical use of thrombin in the nose is effective in controlling capillary bleeding at the time of the operation and postoperatively, but it is not effective against active bleeding from cut vessels.
3. In rhinoplasty, the topical use of thrombin has a marked effect in producing fibrin-fixation of tissues, and aids materially in preventing postoperative edema, ecchymosis and thickening of the nasal tissues.
4. The author considers thrombin a valuable adjunct in rhinologic surgery.

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TINNITUS, DEAFNESS AND DIZZINESS.*

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This ambiguous title was selected because it represents the basic symptoms produced by disturbed physiology of the ear. It would take many papers such as this one to make a comprehensive survey of any one of these symptoms; however, patients do appear with one or all of them, and we must have some practical plan in mind in order to arrive at a workable diagnosis. We assume at the start that the symptoms are genuine.

An exhaustive examination of the ear to determine the cause for any of these symptoms takes considerable time. With our offices pushed to capacity, particularly in the immediate past, we have been tempted to accept a snap diagnosis only to regret it later. A few minutes spent at the time of examination generally saves many more at a later time.

It is quite difficult at times to arrive at a satisfactory conclusion at the first observation, particularly when we encounter a condition in its beginning. When a pimple is forming on the skin surface the patient will feel symptoms in that area long before the true significance of the sensations can be determined or before anything becomes visible. It may even become necessary at times to employ treatment or medication to eliminate one or another possible cause. Nevertheless, there is no excuse for the bad habit of starting routine inflation of the Eustachian tube hoping that some magic will take place at the patient's end of the catheter.

Tinnitus, deafness or dizziness may arise from a peripheral or central condition. The cause for a peripheral disturbance may be found purely locally in the external canal, middle ear

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or otic capsule, or it may have some systemic origin. Likewise, a central lesion may occur locally in the brain itself or again may be the effect of some systemic disturbance upon the brain.

A carefully taken history is of great value in differentiating between a peripheral and a central lesion. As a rule the peripheral lesion will have an abrupt onset with the symptoms shortly becoming less. On the contrary, a central lesion will have a slower insidious beginning with the symptoms becoming worse and more numerous. The history of previous ear trouble is highly significant and must not be overlooked. Although we are not in competition with the family physician, we must learn whether there has been any general systemic trouble.

When these symptoms arise because of a purely peripheral condition such as impacted cerumen, dermatitis, or malformation of the external canal, detection is not difficult. Acute infections of the middle or inner ear may also be observed upon examination. Old lesions of the drum membrane, tympanic cavity or middle ear such as adhesions, perforations or chronic infections are also readily detected. These latter conditions usually have a faulty Eustachian tube in the background or some condition which prevents the tube from functioning properly. In this respect we must look for such related things as a poorly functioning nose, improper bite,¹ distorted or infected nasopharynx.

Infection around the orifice of the tube, particularly in Rosenmüller's fossa, with or without adhesions, has never received proper attention. This location may be the site of acute or chronic infection as well as the sinuses, tonsils or teeth. Infection in this area may produce toxic symptoms besides interfering locally with the function of the tube. The benefit derived from routine inflation of the middle ear comes as often from improvement around the orifice of the tube as from pumping air into an adequately ventilated middle ear. Function of the Eustachian tube may be tested, as will be pointed out later.

After determining that the external canal and tympanic cavity are not at fault, the inner ear must be considered. The audiometer has been of great help in quantitative measurement of the loss of hearing and the location of tone where the loss occurred. There has been a tendency to abandon fork tests since the audiometer appeared. This is a big mistake, because we get our best qualitative information from their use. It takes only a few minutes with a large fork pitched between 256 and 512 to run the essential tests. The fork must be large in order to vibrate long enough to go from one ear to the other even several times when necessary for the patient to arrive at the correct answer. There is no need of doing any test unless it is done properly.

Perhaps the most frequently committed error in the use of forks is improper handling. Sound vibrations come off the flat surfaces of the fork, but off the edges or corners there is no sound, due to nodal lines. This can be demonstrated by slowly turning a fork in front of the ear. If the flat side of the fork be presented to one ear and a corner or edge to the other, the response will be erroneous, and no test will have been done.

Relative air conduction between the two ears, diplacusis, Rinne and Weber tests can all be done in a short time. There has been some dissension about the value of the Gellé test, but it has served me well, particularly when the Eustachian tube is closed; however, if the tube is open the test is functionless. When a pronounced difference in hearing is noticed during the test one may be sure that the stapes is not bound completely with adhesions or the annular ligament is not wholly sclerosed.

The function of the Eustachian tube may be tested by placing a vibrating fork in front of the patient's nose and asking him to swallow. When the tube opens upon swallowing, the fork will be heard for a second most as well as when placed in front of his ear. This test was described by Politzer² but he gave it no name. For the lack of a better one, I have called it "Eustachian Conduction." Many tubes do not open with

each swallow, and in some patients one tube will open more readily than the other. From surveys in undergraduate and postgraduate classes it appears that a tube which opens once in a half-dozen swallows during favorable weather, and with no cold, is adequate to maintain a normal ear. During bad weather or with a cold, the frequency is less often. Among 30 persons, three or four will hear the fork in one ear but not the other. Patients with patent tubes will not notice any change upon swallowing and hear the fork almost as well in front of their nose as in front of their ear. This test has proven of value also in reference to aviation.

The end-organs in which the symptoms of tinnitus, deafness or dizziness originate, regardless of the cause, are contained in the otic capsule. These organs are affected by many conditions which will disturb their normal function or upset the accurate balance between the two sides.

The otic capsule, as we know it in man, is phylogenetically new, particularly the auditory division. Most animals hear faint sounds better than man. This may be due to more acute hearing or that man has learned to disregard such sounds. Nevertheless, animals are unable to appreciate music, neither do they walk upright. The most recently acquired attributes are recognized as the most easily lost; therefore, the ear should be the lowest threshold of all integument special sense organs. The eye, other than the lens, originates from the brain and, therefore, cannot be classified in this group, but it appears early.

The work of Polvogt and Crow³ shows marked anatomic variations in the cochlea, still consistent with normal hearing. It has also been recognized that paired canals of the two sides are often not in the same plane⁴ and yet perform normally. In view of these findings it becomes evident that any influence on these end-organs must affect the actual elements themselves to produce symptoms.

These highly specialized sense organs are very susceptible to external changes as well as changes within the body itself. Sudden changes in air pressure, such as explosions, or in

divers or caisson workers, as well as injuries such as skull fracture, myringotomy, gun or stab wounds produce a marked influence upon the ear. The presence inside the body of such drugs as quinine, salicylates, tobacco and alcohol are indicated early in the ear as the concentration begins to reach each individual's tolerance. Likewise, such diseases as syphilis and exanthemata, foci of infection will show up in the ear early, as the flood of toxins rise according to the individual's susceptibility. The otic capsule is highly sensitive to blood dyscrasias as well as to disturbances of the blood volume. The stria vascularis, which is credited with the formation of endolymph and shows histologic changes in aural dysfunction, probably plays a big part in this marked susceptibility. All of the above influences have been recognized for some time, while more recently we have become aware of the effects of aviation, allergy and endocrine gland imbalance. The dizziness which occurs in men between 45 and 50 due to endocrine gland transition needs additional observation and recognition.

These conditions masqueraded as Ménière's disease for many years. After the chemical influences described by Dida Dederling⁵ and Furstenberg,⁶ as well as hydrops, described by Lindsay,⁷ have been included, it may be possible for us to ascribe a definite cause for all cases with this syndrome.

The VIIth nerve enjoys the same sensitivity to its environments as the end-organ. Neuritis of this nerve occurs frequently with acute or chronic infections. The toxins from some of the germs which produce local epidemics at times seems to have more effect upon the nerve than others.

Chronic degenerative processes must occur which would affect the nerve as well as the end-organ. The higher pitched constant tinnitus which is encountered at times, and which we cannot explain, must be the result of such a process. There is a degenerative condition present in presbycusis, but patients do not complain particularly of tinnitus.

The vestibular tests, as we know them today, too often lead

to disappointment. Whether we have not learned an adequate stimulation or cannot properly evaluate the findings correctly, or have set our aims too high and expect to read too much in the results, is not yet clear.

The spontaneous observations take but little time but may prove to be of great value. Finding an aural nystagmus or marked past-pointing or even a blurring of the optic nerve head may lead our thoughts into the proper channels. At least the need for more extensive examination may be determined and plans made accordingly.

There are many expanding central lesions which do not produce aural symptoms, prior to the appearance of neurologic signs. When they do, however, the history of slowly developing dizziness with an indefinite headache and abnormal vestibular findings may be regarded as highly suspicious of an early lesion. Later, when pressure signs begin to appear, the diagnosis is not so difficult. Choked disk, cranial nerve involvement and definite vestibular results usually lead correctly to an expanding central lesion. With our present facilities, otologists are presumptuous when they try to locate a central lesion from vestibular readings alone. They may be able to designate one side or the other, differentiate between a supra- or subtentorial lesion, but the greatest help comes from a cerebellopontine angle tumor, which neurologists regard as peripheral.

There are many central lesions, not of the expanding type, which may produce one or all of these symptoms. The course is usually slow and often the symptoms are not progressive, such as sclerosing or degenerative processes. The findings in post-traumatic head injury are atypical of this type of case. Frequently, after a head injury the patient will complain of tinnitus, deafness or dizziness, or all, coming on at variable times after the injury. At the same time, all objective signs, vestibular tests and even hearing tests may appear normal.

May our progress in otology continue, and not be snuffed out by the approaching tide of regimentation.

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